PATENT SPECIFICATION

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191,360

Application Date (In United Kingdom): May 19, 1922. No. 14,186/22.

Complete Accepted: May 17, 1923.

COMPLETE SPECIFICATION.

Improvements in or relating to Fluid Pressure Turbines.

We, Société Rateau, of 40, rue du Colisée, Paris, France, a Société Anonyme, incorporated under the laws of the French Republic, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement:—

It is recognized that in known types of turbines a fraction of the energy contained in the steam is recovered in a first rotor, termed the double rotor, which is provided, on its periphery, with a double crown of vanes, on which the steam acts in succession, the direction of the steam being changed by stationary intermediate vanes. These double rotors present several drawbacks, more particularly:

1. The steam loses a fraction of its energy in consequence of the friction created in passing these intermediate vanes, and also as a result of the sudden change of direction it sustains.

2. In order that they may furnish a satisfactory efficiency, they have to be made of fairly large diameter, which increases considerably the frictional losses of the steam. It is known that these losses increase in the proportion of the cube of the number of revolutions and of the fifth power of the diameter, so that it is therefore advisable to have rotors of small diameter, running at very high speed, which is hardly practicable with double rotors.

3. These rotors enable only a comparatively small fraction of the energy contained in the steam to be utilised. The ratio of expansion therein is relatively low, so that they are compelled to rotate in an atmosphere of steam at high pressure, in which the losses through steam friction increase in proportion to the pressure.

In endeavouring to eliminate these drawbacks, certain constructors have designed radial turbines comprising a series of concentric crowns of vanes, secured on two circular discs keyed on separate main shafts which are mounted co-axially and rotate in opposite directions.

The alternating crowns of vanes on the two discs exert a driving action and serve, at the same time, as guide nozzles for the succeeding crown on the opposite disc. The drawback of these turbines is that only a very small fraction of the energy contained in the steam can be recovered in the first vane crowns through which the steam enters; or rather, the peripheral velocity of these vanes in the vicinity of the shaft being low, it follows that the efficiency in this portion of the rotor is unsatisfactory.

Fluid pressure turbines have also been proposed having two rotors, each provided with a single crown of vanes receiving the steam in an axial direction and in series, without the interposition of guide vanes, the rotors being mounted on oppositely revolving shafts, whilst the shaft of the second rotor also carries other discs for which fixed guide nozzles are provided, for completing the expansion of the steam.

The present invention has for its object to provide improved means for the economical utilization of the steam or other fluid under pressure and for eliminating the aforesaid drawbacks, and at the same time for allowing a high efficiency to be obtained.

In accordance with this invention, in a fluid pressure turbine having two rotors receiving steam in series in an axial direction and mounted on oppositely revolving shafts, the shaft of the second rotor turns at a lower speed than the first (preferably one half) and the steam issuing from the casing in which the oppositely rotating rotors are disposed expands in two series of rotors, one series being mounted on the high speed shaft, and the other series on the low speed shaft.

The invention is illustrated by the

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accompanying drawings which represent diagrammatically, in axial section and by way of example, embodiments of the invention.

Figure 1 represents a turbine with two low-pressure members, each comprising a suitable number of rotors keyed on the two shafts and receiving the steam in parallel.

Figure 2 represents a similar turbine to Figure 1, except that the low-pressure members are arranged in series.

In the form of the invention shown in Figure 1 the steam is admitted, through the intake A to a simple first rotor B mounted on a shaft C, coupled with an electric alternator D, adapted to run at a fairly high speed, for example 3000 revolutions per minute. A second rotor E receives in an axial direction, the steam issuing from the rotor B, and is mounted on a shaft F in line with the shaft C and turning in the opposite direction at a lower speed, preferably one half. On an extension of the shaft F are keyed rotors such as G, H, I, in any convenient number, and on a similar extension of the shaft C is mounted a second series of rotors such as X, Y. Pipes O and P conduct the steam from the casing J of the high-pressure rotors B, E, to the casing Q and R of the low-pressure rotors G, H, I, and X, Y, which casings are each in communication with the condenser (not shown) by way of exhausts M and M$_1$. An electric alternator N is mounted on the extension of the shaft F, and may be coupled electrically with the alternator D, which is of smaller power.

The steam expands successively in the two high-pressure rotors B and E, and the expansion of the steam issuing from the rotor E is completed in the low-pressure rotors G, H, I, and X, Y, and the steam finally escapes into the condenser through the exhausts M and M$_1$.

The low-pressure stage members which run at a lower speed than the rotor B, and preferably one-half that speed, may be composed of rotors having double the diameter possible for rotors running at the same speed as the rotor B. The sectional area of the steam passages will therefore be four times as large as if the speed were the same as that of the rotor B, and therefore units of high capacity can be constructed. This arrangement enables machines to be used which are driven at equal or approximately equal power.

Figure 2 represents a modification in which the steam, on issuing from the casing J which houses the high pressure rotors B, and E, next enters a medium-pressure casing W, where it acts on rotors keyed on the high-speed shaft. After traversing this casing it finally enters a low-pressure casing L, where rotors keyed on the low-speed shaft enable the steam to be expanded down to exhaust pressure. In short, this arrangement is the same as that of Figure 1, except that the low-pressure casings which, in the former case, were supplied in parallel are supplied in series as indicated by the arrows.

The turbine, instead of driving coupled or separate alternators, may also drive direct-current generators, blowers (either coupled or separate) or any other machines.

The invention is not restricted to the different details of arrangement, which have only been selected by way of examples of embodiment and for clarity of description. It may also be applied to gas turbines.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A fluid pressure turbine having two rotors receiving steam in series in an axial direction, and mounted on oppositely revolving shafts, wherein the shaft of the second rotor turns at a lower speed than the first (preferably one half), and wherein the steam issuing from the casing in which the oppositely rotating rotors are disposed expands in two series of rotors, one series being mounted on the high-speed shaft, and the other series on the low-speed shaft.

2. A fluid turbine as claimed in Claim 1, wherein the steam from the casing of the oppositely rotating rotors expands, partly in a medium-pressure casing in which revolve rotors keyed on the high-speed shaft, and then continues its expansion in a low-pressure casing the rotors in which are keyed on the low-speed shaft.

3. Fluid pressure turbines constructed and arranged substantially as hereinbefore set forth with reference to the accompanying drawings.

Dated the 19th day of May, 1922.

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[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1

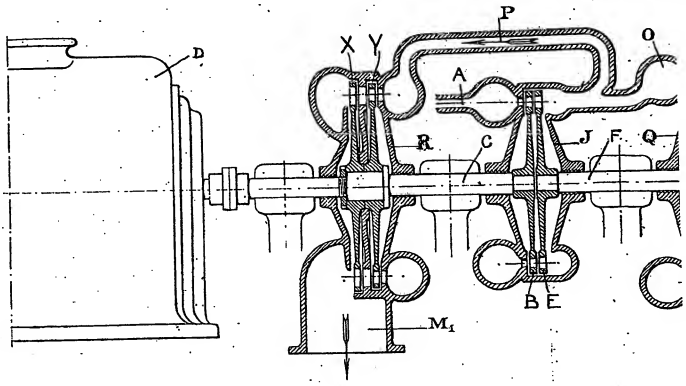

Fig. 2

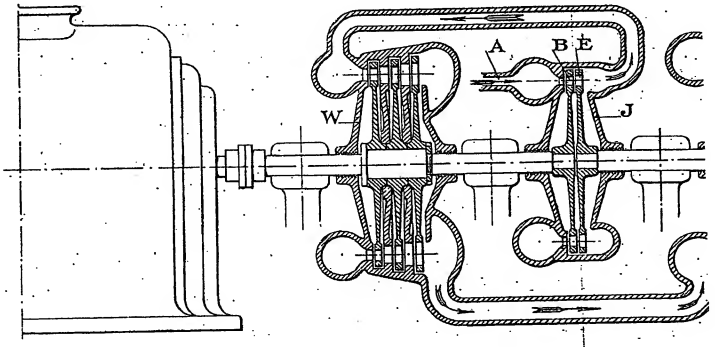

Fig. 1.

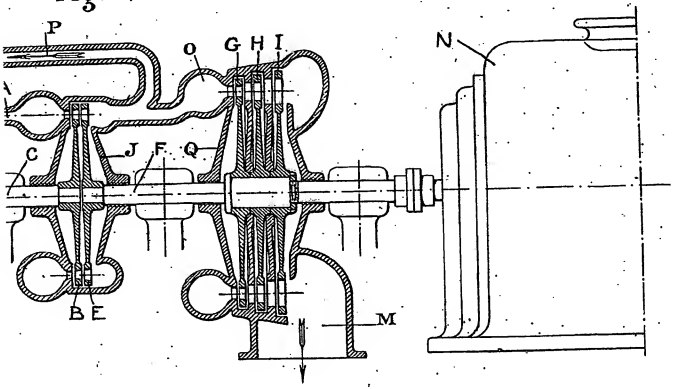

Fig. 2.

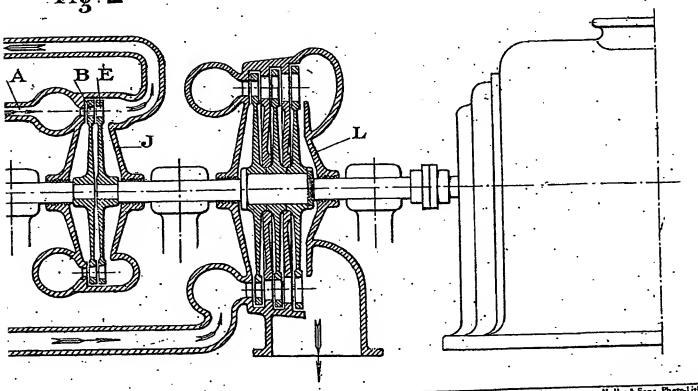

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Fig. 1

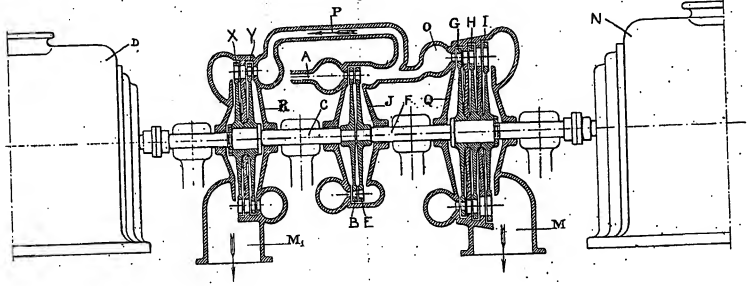
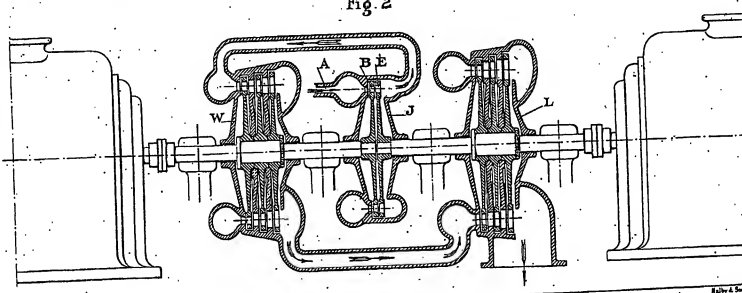


Fig. 2



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